

Claims

[Claim 1]

A semiconductor device comprising:

a wiring board in which electrode pads are formed on the  
5 surface thereof;

a semiconductor element which is disposed on the wiring  
board and in which electrodes are formed on the surface  
thereof;

10 bumps for connecting said electrodes to said electrode  
pads; and

an underfill resin filled between said wiring board and  
said semiconductor element to embed said bumps, wherein

15 said wiring board comprises a solder resist disposed on  
the surface of the side on which said electrode pads are  
formed;

wherein

apertures for exposing said electrode pads are formed on  
the solder resist; and

20 the thickness of said solder resist in the area excluding  
the area directly above said electrode pads is equal to or  
greater than the thickness of said underfill resin disposed  
on said solder resist in said area between said wiring board  
and said semiconductor element.

[Claim 2]

25 The semiconductor device according to claim 1, wherein  
the thickness of said underfill resin disposed on said solder  
resist is 50  $\mu\text{m}$  or less.

[Claim 3]

The semiconductor device according to claim 1 or 2,  
wherein the volume of said bumps is less than the volume of  
said apertures.

[Claim 4]

5 The semiconductor device according to claim 3, wherein  
the thickness of said solder resist is 30  $\mu\text{m}$  or more.

[Claim 5]

The semiconductor device according to any of claims 1 to  
4, wherein said bumps are formed from solder.

10 [Claim 6]

A method for manufacturing a semiconductor device having  
a wiring board in which electrode pads are formed on the  
surface thereof, and a semiconductor element in which  
electrodes are formed on the surface thereof, wherein said  
15 wiring board comprises a solder resist which is disposed on  
the surface of the side on which said electrode pads are  
formed, and which is provided with apertures for exposing  
said electrode pads, said method comprising the steps of:

20 forming bumps on at least one element selected from said  
electrode pads and said electrodes;

depositing a liquid resin material on at least a portion  
of the area in which said semiconductor element is to be  
mounted on said wiring board;

25 pressing said semiconductor element to said wiring board  
to connect said electrode pads, said bumps, and said  
electrodes to each other;

melting and then solidifying said bumps to join said  
electrodes to said electrode pads by way of said bumps; and

curing said resin material and forming an underfill resin so that said bumps become embedded between said wiring board and said semiconductor element, wherein

the distance between said wiring board and said  
5 semiconductor element is controlled during the melting of  
said bumps in said joining step, and the thickness of said  
solder resist in the area excluding the area directly above  
said electrode pads is equal to or greater than the thickness  
of said underfill resin disposed on said solder resist in  
10 said area between said wiring board and said semiconductor  
element after said underfill resin has been formed.

[Claim 7]

The method for manufacturing a semiconductor device  
according to claim 6, wherein the volume of said bumps is  
15 less than the volume of said apertures in the step for  
forming said bumps.

[Claim 8]

The method for manufacturing a semiconductor device  
according to claim 7, wherein the thickness of said solder  
20 resist is 30  $\mu\text{m}$  or more.

[Claim 9]

The method for manufacturing a semiconductor device  
according to any of claims 6 to 8, wherein the distance  
between said wiring board and semiconductor element is  
25 controlled by controlling the relative position of said  
semiconductor element with respect to said wiring board in  
said joining step.

[Claim 10]

The method for manufacturing a semiconductor device according to any of claims 6 to 8, wherein

    said bumps are melted while said semiconductor element is being pressed to said wiring board; and

5       the distance between said wiring board and said semiconductor element is controlled by controlling said pressing force in said joining step.

[Claim 11]

The method for manufacturing a semiconductor device  
10      according to any of claims 6 to 10, wherein a resin material to which a chemical capable of removing an oxide film is added is used as said resin material.

[Claim 12]

The method for manufacturing a semiconductor device  
15      according to any of claims 6 to 11, further comprising a step of carrying out plasma treatment on at least one surface selected from the surface on the side on which said electrode pads are formed on said wiring board, and the surface on the side on which said electrodes are formed on said  
20      semiconductor element, between the forming of said bumps and the depositing of said resin material.